

A large, stylized black flame graphic on the left side of the page, composed of several sharp, upward-pointing tongues of fire.

EXPLOSIVES

Kansas City, MO
November 29, 1988



FIRE INVESTIGATIONS

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Fire Investigation Report

**Blasting Agent Explosion
Six Fire Fighters Killed
Kansas City, Missouri
November 29, 1988**

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Publishers of the National Fire Codes® and National Electrical Code®

A non-profit membership organization dedicated to promoting safety from fire, electricity, and related hazards through research, codes and standards, technical advisory services, and public education since 1896.

ABSTRACT

The November 29, 1988 explosion occurred at a highway construction site and claimed the lives of six Kansas City, Missouri fire fighters. Investigators have determined that two fires were deliberately set and that the material that detonated was an ammonium nitrate based blasting agent.

At approximately 3:40 a.m., the Kansas City Fire Department received a telephone call reporting a pickup truck fire, and one engine company with three fire fighters was dispatched to the location. The dispatch center indicated the potential for explosives being involved, and the responding pumper crew acknowledged that information. When the pumper arrived at the scene, the crew reported that there were actually two separate fires at different locations and requested assistance. A second engine company with three fire fighters was dispatched to the scene. The responding engine company was also informed of the potential for explosives, and they acknowledged this information. Upon learning that the second fire involved a trailer that might contain explosives, a battalion chief was also dispatched.

After extinguishing the fire in the pickup, the first engine company joined the second engine company, which had responded directly to the location of the second fire, the burning trailer. Believing that an explosion had already occurred in the trailer, the engine companies were preparing for an attack when the explosion occurred, killing the six fire fighters. After this explosion, the battalion chief, who had arrived on the scene just moments before but was far enough away to survive the blast, kept fire fighters from additional companies at a safe distance and let the remaining fire burn. About forty minutes later, a second explosion involving the contents of another trailer occurred without additional casualties.

Of the several lessons resulting from this incident, the following are the most important:

1. Blasting agents such as ANFO can be extremely hazardous when exposed to fire and can detonate.
2. Prior to the alarm, the Kansas City Fire Department apparently did not have knowledge of specific details such as the type, quantities and location of the blasting agents. Permit systems for storage and use of explosives or blasting agents must include notification to the fire department.
3. It is normal practice to remove hazardous materials warning signs once an over-the-road trailer has reached its destination. Better marking of the areas of storage or the trailers might have saved lives in this case, given the lack of detailed prior knowledge about the location of the dangerous materials.
4. In addition to notification of fire departments about the location of explosives and blasting agents through a permit system, adequate pre-fire planning conducted by fire fighters can serve to locate hazardous materials throughout a department's jurisdiction. Such data gathering and inspections can find unexpected dangerous materials before an emergency occurs and thus save lives of fire fighters and civilians.

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I. INTRODUCTION

The National Fire Protection Association (NFPA), with the assistance of the International Conference of Building Officials (ICBO), investigated the Kansas City, Missouri fire and explosion in order to document and analyze significant factors that resulted in the loss of life.

This study was funded by the NFPA as part of its on-going program to investigate technically significant incidents. The NFPA's Fire Investigations Division documents and analyzes incident details so that it may report lessons learned for life safety and property loss prevention purposes.

The NFPA was assisted in data collection and analysis by ICBO under an agreement between NFPA and the three model building code organizations to investigate significant structural fires and other emergencies throughout the United States. In addition to ICBO, the other cooperating model building code groups are the Building Officials and Code Administrators International (BOCA), and the Southern Building Code Congress International (SBCCI). The three model building code groups assist NFPA by providing technical staff support for on-site field work and building code analysis. NFPA also recognizes the assistance provided by the Bureau of Alcohol, Tobacco and Firearms (ATF).

The NFPA became aware of the fire on the day of occurrence, November 29, 1988. Within one day, Michael S. Isner of the Fire Investigations Division was in Kansas City to document the facts related to the fire and explosion. The NFPA investigator was joined and assisted by Mr. William D. Wall, ICBO. A three-day on-site study and subsequent analysis of the event were the basis for this report. Entry to the fire scene and data collection activities were made possible through the cooperation of the Kansas City Fire Department and the Missouri State Fire Marshal's Office. This report presents the findings of the NFPA data collection and analysis effort.

This report is another of NFPA's studies of fires having particular educational or technical interest. The information presented is based on the best data available during the on-site data collection phase and during the report development process. It is not NFPA's intention that this report pass judgment on, or fix liability for, the loss of life and property during this incident.

The cooperation and assistance of Kansas City Fire Chief Edward W. Wilson, Kansas City Fire Marshal Robert Wallace, State Fire Marshal John Coburn, and Investigator Robert Miller of the State Fire Marshal's Office are acknowledged and appreciated.

Special thanks are given to Mr. William D. Wall, Regional Engineer, of ICBO for his contributions to this report. In addition to providing assistance in the data collection phase, he was instrumental in preparing the sections of the report that pertain to the city of Kansas City Codes, and to the Uniform Fire Code, and he actively participated in the formulation and review of this report.

II. BACKGROUND

The Construction Site

This incident occurred in a rock excavation site approximately nine miles south of the center of Kansas City, Missouri. The site, which covered about one eighth of one square mile, was on property leased by the construction company, and the area was bordered by two thoroughfares. (See Figure 1.) The south side of the site faced 87th Street, a two-lane road that is used by approximately 9200 cars each day. The west side of the site faced a four-lane road, US 71, that carried an estimated 32,000 cars each day. This road had a median strip, several crossover roads, and traffic lights.

Contractors for this project were under contract with the state highway department and were removing rock that was to be used as fill material for a new state highway. In order to reach the bedrock, which appeared to include both limestone and shale, workers removed trees, other vegetation, and topsoil covering the rock. Once uncovered, blasting was necessary to break up the bedrock for removal. The blasting subcontractor was issued a permit for his work on September 8, 1988 by the city engineer and was using an estimated 8,000 to 10,000 pounds of blasting agent every work day.

One of the work areas on the site was 50 to 75 feet above the grade of US 71. Two access roads allowed workers to drive their heavy equipment, i.e., bulldozers, front-end loaders, and earthmovers, between the blasting site and the equipment parking area on the west side of US 71. Some of the dirt, small rocks, and other surface materials from the blasting site were piled along the west edge of the elevated work area forming a berm approximately 12 feet high, 100 to 150 feet wide, and 250 feet long.

Several vehicles and pieces of equipment were parked and remained overnight on the east side of the berm. Two air-powered mobile drills were attached to a compressor and a gas powered light trailer was also in the area. In addition, two semi-trailers were parked in the area, and a pickup truck was parked against the rear doors of one trailer.

Reportedly, the trailer furthest from the berm (Trailer #1, Figure 1) was a typical dual axle, 35 foot long, enclosed, over-the-road semi-trailer with two rear doors and a side door. The trailer contained 17,000 pounds of ammonium nitrate fuel oil (ANFO) plus aluminum mixture in 5-inch and 6-inch diameter bags, commonly called socks, and 3,500 pounds of pure ANFO in 50 pound bags. ANFO is classified as a "Blasting Agent."¹

Reports also indicated that the other trailer (Trailer #2) was also a typical dual axle, enclosed, over-the-road semi-trailer. However, this trailer was 38 feet long, had doors only at the rear, and contained 30,000 pounds of ANFO plus aluminum mixture in 30-pound socks.

It was indicated that both trailers had extruded aluminum frame components for the cargo box and sheet aluminum sides and roofs. The trailers had interior wall surfaces lined with 1/4-inch plywood up to a 4-foot height and wood floors. Typically, the wood floors in trailers used to haul explosives are a standard 1 1/2-inch thick hardwood, and the screws are countersunk. Both trailers reportedly had four vent doors, two in the front and two in the rear, and the trailers were reportedly 15 years old, uninsulated, and in good condition.

The manufacturer and supplier of the blasting agent owned the trailers. When a delivery was made, the driver for the manufacturer would leave the blasting agent in the trailer and park the trailer at the construction site. Reportedly, it was standard practice of the blasting agent manufacturer to comply with Department of Transportation requirements for placarding. Accordingly, the trailers displayed placards with the words "Blasting Agent" while traveling over the road. When the trailers were parked at the scene, the "Blasting Agent" placards were reportedly removed (folded up), and the placard then displayed the words "Please Drive Safely."

According to Table 6-3 of NFPA 495, Manufacture, Transportation, Storage, and Use of Explosive Materials, 1985, the parked trailers can be considered Type 5 magazines as long as they are weather resistant and can be secured against theft. Since the trailers were reportedly enclosed cargo trailers and in good repair, it appears that they would have met the weather resistance criterion. The explosives manufacturer also indicated that a king pin lock was installed when the tractor was removed and that the

contractor installed his own locks on the trailer doors. Therefore, the security criteria outlined in Section 6-6.5.1 appeared to have also been met.

There were two other magazines on the site. Both were painted yellow and located on the east side of the large pile of trees, stumps, rocks, and other debris. One magazine was an estimated 5 ft X 5 ft X 5 ft metal box about 340 feet from Trailer #1, and the second was an estimated 7 ft X 7 ft X 8 ft metal box about 210 feet from Trailer #1. One magazine contained 2500 pounds of dynamite and the other contained 2000 blasting caps.² Both NFPA 495 (Section 6-2.3) and the Uniform Fire Code (UFC) (Section 77.201h) prohibit storing explosives and blasting caps in the same magazine.

Vandals reportedly had been tampering with the construction equipment so two security guards were hired to patrol the area after working hours. Under normal conditions, one guard was responsible for watching the rock blasting area and the other was responsible for watching the contractor's equipment parked on the west side of US 71.

Ammonium Nitrate

The chemical ammonium nitrate (NH_4NO_3) has many uses, though the two most common are ammonium nitrate as an ingredient of fertilizers and ammonium nitrate as one of the ingredients in explosives, especially blasting agents. When exposed to fire, fertilizer-grade ammonium nitrates (ANs) typically oxidize, decompose into toxic oxides, and provide additional fuel to a fire.³ The NFPA standard that addresses the storage of AN is NFPA 490, Storage of Ammonium Nitrate.

The explosive potential of this material was highlighted by several disasters that occurred during the first half of the twentieth century, with the most well-known incident being the explosion in Texas City on April 17, 1947 of the S.S. Grandcamp, which contained fertilizer-grade ammonium nitrate.^{4,5} In the following years, the amount of impurities in fertilizer-grade ammonium nitrate has been reduced and it is no longer coated with wax to prevent caking.⁶ These improvements have reduced the risks associated with most fertilizer-grade ANs. However, if fertilizer-grade ammonium nitrate becomes contaminated by petroleum products or other materials, its potential for detonation greatly increases, and the material begins to resemble the blasting agent called ANFO.

Ammonium Nitrate - Fuel Oil (ANFO)

ANFO is the most common explosive used in the United States. Over two billion pounds of ANFO were produced in 1975, and this accounted for approximately 80 percent of the domestic commercial explosives market that year.⁷ Current estimates indicate that ANFO is now being used in about 90 percent of all blasting operations in the United States using nonnitroglycerin materials.⁸ The storage of ANFO and other ammonium nitrate-based blasting agents is addressed by NFPA 495.

ANFO is predominantly in the form of a prill, a small porous pellet, and mixed with fuel oil. This product is usually a pre-mixed, oxygen-balanced, free-flowing mixture of about 94 percent ammonium nitrate prills and six percent No. 2 diesel fuel oil. Other ANFO products are modifications of this basic formula in which: (1) substances such as aluminum or coal are used in place of or in addition to the No. 2 diesel fuel; (2) the ANFO prill is crushed; and (3) the ANFO product is packaged in a water-resistant package for use in wet boreholes.⁹ The materials, such as aluminum, are added to ANFO to increase the general strength of the explosive.¹⁰ The different mixtures of ANFO are sometimes referred to as nitrocarbonitrates (NCNs) or low density blasting agents.¹¹

Compared to nitroglycerin dynamites, the cost of ANFO is low, but this is not the only advantage that ANFO has as a blasting agent. It is less sensitive to shock and does not burn-to-detonation as readily as other nitroglycerin-based explosives.¹² Yet, under proper conditions, ANFO can produce explosion pressures similar to TNT and explosion velocities similar to dynamite.¹³

While ANFO does not burn readily, it can still burn and produce a detonation in a well-established fire.¹⁴ Porter indicates that incipient fires involving blasting agents that are not confined can be fought with large amounts of water. Since ammonium nitrate is an oxidizer, the fires cannot be smothered. The water acts only to cool the burning mass to temperatures below the ignition temperature.¹⁵ When fires develop beyond the incipient stage, the only safe method for handling the situation is to abandon direct fire fighting methods and evacuate the area in anticipation of an explosion. The suggested evacuation distance is 2000 feet.¹⁶ Section 7-1.6 of NFPA 495 indicates that when fires cannot be controlled before reaching explosive materials, including ANFO, they should not be fought.

Similarly, the Bureau of Explosives and the Department of Transportation state that fire fighters should not fight fires that directly involve ANFO or other explosive materials.^{17,18} Instead, fire service persons should withdraw to a safe distance.

Local Codes

In the Fire Prevention and Protection Section of the Kansas City Code there are two articles that relate to blasting. Article III. Blasting requires blasting permits to be obtained prior to doing any blasting within the city limits. This process, as prescribed by the ordinance, was handled by the city engineer's office and requires that a determination be made that the blasting could be accomplished without danger to life and property before issuing the permit. Execution of a bond that indemnifies the city from damage must also be received before the permit is issued. Article V. Fire Prevention and Protection Code of the Kansas City Code incorporated the 1982 Edition of the Uniform Fire Code. The UFC has provisions that relate to the storage, use, and handling of explosives and blasting agents.

Fire Department

The Kansas City Fire Department protects a 320 square mile community with a population of 448,000 people. The department's 751 operations officers and fire fighters are divided between three 24-hour shifts. Each shift has seven battalion chiefs and one deputy chief. An additional battalion chief supervises the fire fighters assigned to protect the Kansas City International Airport. In addition to operations personnel, the department has 45 personnel in administrative, clerical, fire prevention, dispatch, and training positions. During the fiscal year ending on April 30, 1988, the department responded to 25,353 calls. Of those calls, 11,103 were medical, 5,233 were fire, and the rest included false alarms, good intention, service, hazardous conditions, and miscellaneous.

The department has 32 fire stations throughout the city and operates 33 pumpers, seven squads, and 15 trucks, which include three quints,¹⁹ one aerial platform, and 11 ladder trucks. The pumpers are typically staffed with an officer, a fire apparatus operator, and a fire fighter. The squads have a two fire fighter crew and the trucks typically have four personnel.

When an individual is selected to be a Kansas City fire fighter, he/she is required to complete a 3-month introduction to fire fighting course. This course is fashioned after fire fighter training courses developed by the National Fire Academy (NFA) and introduces personnel to fire fighting procedures, to fire prevention activities, and to the department's standard operating procedures (SOP) such as the one for hazardous materials response.

The Kansas City Fire Department SOP for handling hazardous materials that was in effect at the time of the explosion was dated March 1, 1981. This 12-page document outlines the duties and responsibilities of dispatchers, the officer who arrives first at the scene, the incident commander, and others. Among the many procedures, the SOP states that "the dispatcher will obtain answers to as many questions on FD 100 as possible," and "he/she will convey by radio, as the companies are en route, such information as amount and type of material involved, type and size of container,..." The SOP also states that the first officer on the scene will "advise other responding units of the situation and precautions to be taken" and "notify dispatcher by radio of situation and action taken."

All six fire fighters that were killed had received the department's introductory hazardous materials training. In addition, four of the six fire fighters had received other hazardous materials field training. All four had completed the NFA course, "Recognizing and Identifying Hazardous Materials." In addition, two of these four, an officer and a fire fighter, had completed the second NFA course, "Hazardous Material Incident Analysis."

In addition to their training, the six fire fighters had many years of experience. The officer on the first responding pumper had been on the department for 29 years and the operator and fire fighter on this pumper had 20 and 12 years experience, respectively. The officer on the second pumper had 38 years of experience, and the operator and fire fighter had been on the department for 10 and 15 years, respectively.

In the year preceding this incident, the Kansas City Fire Department had been assembling a hazardous materials response team. Eighteen fire fighters and at least three battalion chiefs had received supplemental training regarding hazardous materials incident handling. The trained fire fighters were randomly assigned to shifts and dispersed throughout the fire stations. However, every shift had one of the trained battalion chiefs. The department was in the process of equipping a truck for use as a hazardous materials response vehicle. This truck was not operational at the time of this incident.

III. FIRE INCIDENT

Fire Discovery and Fire Department Notification²⁰

Shortly after 3 a.m., one of the guards at the construction site thought she had seen a prowler and radioed to the other guard. The two, who were in separate vehicles, joined together, left their pickup truck near the parked contractor's equipment, and continued their search for the prowlers.

Finding no prowlers on the site, the guards drove to a nearby convenience store to see if anyone there had seen two people come out of the construction site on foot. While the guards were at the store, a motorist stopped and reported that a vehicle was burning at the construction site. The guards returned to the site and found that the cab of the pickup they had just parked was involved in fire.

Using the phone in his car, one of the guards called the Kansas City Fire Department at 3:40 a.m. and reported a fire in a small pickup truck on Highway 71, in the southbound lane. While this guard was talking with the dispatcher, the other guard noticed a fire on the hill. The tape recording of the telephone conversation captures, in the background, the second guard stating, "Oh, the explosives are on fire." Moments later the original caller stated, "Ah, there may be some... ah, there's some explosives up on a hill that I also see now is burning." The dispatcher's reply, "OK, we'll have units there. Thank you."

Fire Department Response

At 3:42 a.m. the dispatch center started the initial response with this transmission:

"Dispatcher: Pumper 41. This is a pickup truck at... south of Blue River and 71 Highway on the west side. Pumper 41, reported to be a pickup truck on Blue... it's just south of Blue River and 71 Highway on the west side.

Pumper 41, use caution on your call. There's information there may be explosives. It's in or at a construction area. The pickup truck may be in that area."

Pumper 41, which would have traveled north on US 71 to reach the scene, arrived at 3:46 a.m. and at 3:47 a.m. radioed back to dispatch that there were two fires. This crew asked for a second pumper to be dispatched to the scene. The dispatcher acknowledged the transmission and sent Pumper 30, which would have traveled south on US 71 to reach the scene and would have passed very close to Pumper 41 at the pickup truck fire. Pumper 30 arrived on the scene at about 3:53 a.m.

At 3:57 a.m., Pumper 41 radioed the dispatch center, reported that the fires appeared to be arson, and requested that the police be sent. Moments later, the following transmissions were made:

"41 to dispatcher."

"Dispatcher: 41"

"41: If you can get 30 tell them that there's the trailer on fire up there, stay away from it, and we better have (battalion chief) 107 out here. There's supposed to be explosives involved in this."

"Dispatcher: Do you want 107 emergency?"

"41: Yeah, you can send him emergency."

"Dispatcher: Car 107, make the alarm, the companies are...um...just south of Blue River and 71 Highway. Pumper 41's on the west side. Car 107, make the alarm, be just south of Blue River and 71 Highway on the west side."

At 3:59 a.m., Pumper 30 asked the dispatcher if he could confirm that there were explosives in the trailer. The dispatcher responded with the following statement:

"Pumper 41 advised that, and we have initial information on the original call that there were explosives in that area to use caution."

Pumper 30 acknowledged the transmission and then asked to have 41 at their location when they were through. The dispatcher immediately asked 41 if they received the message, and Pumper 41 indicated that they had and that they were en route to join Pumper 30.

Like Pumper 30, Pumper 41 used the north access road, drove up the hill, and parked between Trailer 1 and Trailer 2. Apparently Trailer 1 was heavily involved in fire, and at 4:02 a.m., Pumper 41 had the following conversation with BC 107:

"41: The way it looks right now, we're going to have to haul some water up in here with a squad or something. We've got a trailer, and part of a compressor goin' up here."

"107: You need a four-wheel drive back in there?"

"41: Yeah, you can get a four-wheel drive back in here."

At 4:04:49 a.m. Pumper 41 made the following transmission to BC 107 who was still en route to the scene:

"41: Apparently, this thing's already blowed up, chief. He's got magnesium or somethin' burnin' up here."

"107: 10-4. Are you back up in there now, or where are you?"

"41: Yeah, 10-4 both companies are back up in here."

"107: Can you get in off 71?"

"41: Right. It's ah... it's a road they're usin' for construction here."

"107: 10-4."

Battalion Chief 107 arrived on the scene at 4:06:21 a.m., drove up the north access road, and stopped near the guards who had parked their vehicle near the north end of the berm. From this position, the chief could see a trailer was glowing red and that some fire fighters were still pulling hose from one of the pumpers and some had already begun to apply water. The battalion chief's driver had left his car and was standing next to the other vehicle talking with the guards.

Having sized-up the situation from his position about 340 feet from the burning trailer, the battalion chief was preparing to have the pumpers leave the area when the explosion occurred. The blast was so powerful that the battalion chief's driver was injured, the guard's vehicle was pushed

back about 25 feet, and the blast could be heard back at the dispatch center about nine miles from the scene.

At 4:08:15 a.m. Battalion Chief 107 made the following transmission:

"... Explosion just as we pulled up in here. Get us a ... all kinds of ambulances in here, get us ambulances ... and uh, at least a couple of, three more companies."

The dispatcher asked if he was reporting an explosion and if he was going to need extra companies. Battalion Chief 107 responded "10-4" and asked for ambulances. When the dispatcher asked if they were for fire fighters, he said:

"107: 10-4. We blowed the windshield clean out of our car and we're a quarter-mile away."

The dispatcher immediately sent two more pumpers, two quints, and a squad, and he also contacted the department chief to ensure that he was aware of the explosion. In the same minute, the dispatcher reminded all responding companies to "use caution goin' in, apparently there are some explosives in the area."

Battalion Chief 107 asked the dispatcher to confirm that Pumpers 30 and 41 had been at the scene fighting the fire and the dispatcher responded "30's was, as far as we know, they were near the trailer. 41's was coming up to 'em." Battalion Chief 107 then called to pumpers over the radio and there was no response. A few moments later he gave these orders:

"Give us what hazmat expertise you have out here. Notify everyone that we want to keep everyone back away from the area until we know more about it. And see if you can find someone from the, uh, people who are workin' here to see if we can find more about the area."

The dispatcher contacted the Kansas City, Kansas hazardous materials team and tried repeatedly to contact Pumpers 30 and 41 crews, but no one responded.

A bright white fire producing white sparks of light continued to burn vigorously on the hill. Because fire fighters were being held back, it was not possible to determine what was burning, what was being exposed to the fire, or how this fire was affecting the fire fighters from Pumps 30 and 41. At 4:22 a.m., the dispatcher informed Battalion Chief 107 that they had received information indicating that there may be more depots of explosives in the area that had not exploded. Upon receiving this information, all personnel and apparatus were withdrawn from the area and a command post/staging point was established approximately a half mile away at 95th Street.

Even with the knowledge that the crews of Pumps 30 and 41 were still in the area of the fire and the hope that they might still be alive, fire fighters remained out of the area until they could be assured that the area was safe for entry. At 4:48 a.m. the second explosion occurred without injury to fire fighters. The bright fire continued to burn even after this blast.

About ten minutes after this explosion, the Kansas City, Missouri hazardous materials officer attempted to observe the fire area from a helicopter and determine if fire fighters could safely enter the area. Staying at what the officer felt was a safe distance, the observer could not clearly see the blast area due to the obscuring smoke and the darkness.

At about 5:20 a.m., the hazardous materials officer, who had completed his reconnaissance flight, and another Kansas City Fire Department officer performed an on-the-ground reconnaissance of the blast area. They walked into the blast area, located the bodies of five of the six fire fighters, observed that some of the unexploded material was scattered throughout the area and still burning, and left the area. Having confirmed the condition of the two pumper crews and being concerned about the presence of unexploded materials, these officers felt it would be best to keep all personnel out of the area until after sunrise.

Between 6:00 and 6:30 a.m., it was decided that there was enough daylight to allow personnel to see any potential dangers in the area of the blasts; permission was granted to police and fire personnel to enter the fire scene. Most police officers entered the area from the north access road and the Kansas City Fire Chief, the two officers involved in the on-the-ground reconnaissance, BC 107, and representatives of the state fire marshal's

office entered the scene via the south access road. By the time the fire department officers entered the area, the police had declared the site a crime scene and asked the fire department to limit their activities in order to preserve any evidence. Following the initial crime scene investigation by the police department, the bodies of the fallen fire fighters were removed.

SUMMARY TIME LINE*

3:40 a.m.	Guards at construction site report pickup truck fire and indicate that explosives are on fire on the hill.
3:42 a.m.	Pumper 41 is dispatched to pickup truck fire and is warned of the possibility of explosives being involved.
3:46 a.m.	Pumper 41 arrives on the scene.
3:47 a.m.	Pumper 41 reports two fires and requests assistance. Pumper 30 is dispatched to the scene.
3:53 a.m.	Pumper 30 arrives on the scene.
3:58 a.m.	Pumper 41 requests a battalion chief and warns Pumper 30 that there is a trailer on fire and that explosives are supposed to be involved. Pumper 30 acknowledges the information.
3:59 a.m.	Pumper 30 asks Pumper 41 to come to their location.
4:04 a.m.	Pumper 41 tells dispatcher that it appears that the trailer had already blown up and that there is magnesium or something burning.
4:06 a.m.	Battalion Chief 107 is on scene.
4:08 a.m.	First explosion occurs and six fire fighters are killed.
4:48 a.m.	Second explosion occurs and no one is injured.
6:00 - 6:30 a.m.	Police and fire personnel enter the fire scene.

*For more detailed Time Line, see appendices.

Casualties and Damage

All six fire fighters from Pumpers 30 and 41 were killed by the first explosion. The location of the bodies has been provided in Figure 2. The only person physically injured was the battalion chief's driver who was standing next to the guard's vehicle on the north access road. This fire fighter received only minor injuries and was released from the hospital the same day.

Pumper 41 was closest to the crater where Trailer #2 had once been. The majority of this vehicle's body was missing; however, the fire pump and the occupant cab were still attached to the chassis. The remaining components of the cab were so heavily damaged that this portion of the pumper was almost indistinguishable. Rock, dirt, and other debris covered much of the wreckage of Pumper 41. Pumper 30 lay about 8 to 10 feet south of the other pumper. Though heavily damaged, this vehicle was recognizable and the majority of the major body components remained in their relative positions on the vehicle chassis.

Three craters marked the locations of the parked trailers. Two craters, one 38 feet across and 6 feet deep and the other 20 feet long and 4 1/2 feet deep, were formed when Trailer #1 exploded. It is not known why the two craters were formed, but an imaginary line drawn between the center of the craters corresponds to the longitudinal axis of Trailer #1 as it was reportedly parked. The third crater shows where Trailer #2 had been parked. This crater was 49 feet across, 6 1/2 to 7 feet deep, and had a 20-foot elongation at one point. Though the cause of the elongation is not known, it has been assumed that the direction of the elongation corresponds to the longitudinal axis of Trailer #2.

Any pieces of the trailers that were found lay in areas away from the craters. A 5-foot long piece of what appeared to be part of a trailer frame was about 60 feet southeast of Trailer #1. A large piece of trailer body with the explosives manufacturer's name still printed on it lay near the position where the battalion chief parked his car. Many small pieces of trailer body were found on the berm, and several pieces landed on US 71. Some of the observed pieces had small puncture holes and were bent inward as if an outside force caused the damage to the trailer skin.

The pickup truck that was parked against Trailer #1 was heavily damaged with the cab being peeled back almost to the cargo box and was blown about 40 feet away from its original location. The air compressor and one of the drilling units were damaged but apparently remained near their original locations. Another drilling unit was dismembered by the blast, and parts of this unit landed on the wreckage of Pumper 41. A portable light trailer was blown into and almost through Pumper 30.

Reportedly, a 3 X 4 foot piece of metal from the body of one pumper landed approximately 25 feet south of 87th Street. The pieces of debris that this investigation team observed furthest from the blast area were a part of the trailer body and the tailgate from the pickup truck that had been parked at the rear of Trailer #1. These parts were found along the north side of 87th Street and were about 450 feet from Trailer #1. In addition, BC 107's car which was 340 feet from the blast areas was notably damaged.

Though some reports indicate the distances might be even greater, people ten miles away from the construction site have stated that they heard the first blast. The majority of broken windows and damage to structures occurred to buildings within 30 blocks of the blast area.

IV. ANALYSIS

Fire Cause and Origin

Kansas City Police and the Bureau of Alcohol, Tobacco and Firearms (ATF) investigators have determined that the fires in the pickup truck and in the first trailer were intentionally set and are proceeding with an arson/homicide investigation. Preliminary information from their investigation indicates that a flammable liquid was used as an accelerant in the cab of the pickup and is suspected in the fire that was started outside of Trailer #1. At the time that this report was being prepared, the case was still under investigation and no suspects had been identified.

Fire Growth and Explosions

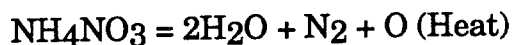
If the fire involving Trailer #1 was started by a flammable liquid as the local and ATF investigators believe, it appears that a fire outside the trailer would have melted a small portion of the trailer's exterior aluminum walls before it could burn through the 1 1/2-inch thick floorboards. Once a hole was burned through, the exterior fire would have ignited the contents of the trailer.

The fire involving Trailer #1 probably was beyond the incipient stage and rapidly growing at the time the guard saw it from her position by the burning pickup truck some 800 feet to the west. From this position, the hill and the berm would have hidden the trailer from sight. Therefore, in order for the guard to see the fire, there must have been substantial flames that could be seen over the berm, enough smoke to reflect light coming from the flames, or sufficient light to brighten the area.

Fire fighters found an extremely intense fire when they arrived at the burning trailer. Though Pumper 30's crew never described the fire over the air, a member of Pumper 41's crew implied a severe fire when he requested that additional water be brought to the scene. Apparently, he felt the water carried on each pumper was not sufficient. The fire fighter from Pumper 41 provided even more confirmation of an intense fire when he radioed that it appeared the explosion had already occurred and that magnesium or something was burning. The battalion chief's recollection of a glowing red trailer corroborates Pumper 41's apparent assessment that the fire was intense.

Plywood lining the interior of the trailer walls and the hardwood floors are not capable of producing a fire of the intensity described by the fire fighters. Under normal conditions, the aluminum alloys used for the construction of trailer bodies will melt at about 1200°F. The molten material may have formed pools, but this material would not have burned. It appears that the only other available fuel was the ANFO and ANFO plus aluminum mixture stored in the trailers.

ANFO is classified as a blasting agent and not as a flammable solid.²¹ Nonetheless, ANFO still can burn in the absence of any other fuel. When decomposing, AN (NH_4NO_3) in ANFO liberates about 1/3 of its available oxygen as the following simplified reaction equation reveals:



The oxygen radical produced is then free to combine with carbon and hydrogen contained in the fuel oil (CH_x). The addition of aluminum provides even more fuel for reactions and will intensify an ANFO fire.

Van Dolah indicated that ANFO plus aluminum will burn vigorously and produce a bright white flame with white smoke.²² Such a fire clearly exceeds the intensity of one involving standard combustible materials. It appears reasonable that the burning ANFO plus aluminum in Trailer #1 could have produced enough heat to quickly melt a large portion of the aluminum skin and aluminum frame of the cargo box.

When the fire fighter from Pumper 41 reported that it appeared the explosion had already occurred and that magnesium or something was burning, the fire fighter probably saw that part of the trailer was missing, but it would have been as a result of melting aluminum and not because of an explosion. The burning "something" would have been the ANFO and the ANFO plus aluminum mixture.

The ANFO and the ANFO and aluminum mixture in Trailer #1 burned intensely for about 30 minutes before detonating.

The fragments of trailer siding that were found on the berm indicate that Trailer #2 was heavily damaged by the blast from Trailer #1. Unburned pieces were thrown clear of the blast and fire area, and many of these pieces had evidence of being struck on the outside by rocks and were bent inward by forces outside of the trailer. If the observed pieces had been

from Trailer #1, one would expect to find evidence of an internal pressure forcing the trailer walls outward. A blast force sufficient to blow fragments from Trailer #2 onto the berm would have also caused a shock stress on the commodity stored inside. Shock is one of the factors that can affect the sensitivity of ANFO mixtures. In addition, the blast force would likely have upset the storage arrangement of the materials in Trailer #2. Some of the material could have been blown around, but most of the material probably stayed in a pile.

It appears that the first blast ignited the ANFO plus aluminum mixture in Trailer #2 and, once ignited, the material burned intensely for about 40 minutes and again detonated. As was the case during the fire in the first trailer, the ANFO plus aluminum mixture was the primary fuel for the fire.

Blasting agents are generally considered safer than Class A, B or C explosives and yet, when properly initiated, they can function in the same manner as Class A explosives. Not being cap sensitive, they require a strong primer.²³ The Kansas City incident clearly shows that, under fire conditions, ANFO mixed with aluminum can detonate without the presence of other explosives of higher categories, i.e., Explosives A, B, or C.

Two other incidents that highlight the hazards associated with explosives and blasting agents under fire conditions occurred in Roseburg, Oregon and in Marshalls Creek, Pennsylvania:

- In August 1959, a truck exploded in Roseburg, Oregon, killing 13 persons and injuring 125. The truck, loaded with blasting agent (ANFO) and dynamite, was parked overnight next to a building materials warehouse. The fire department was fighting a fire in the warehouse and was not aware of the truck and its dangerous cargo. Fire exposure detonated the explosive materials destroying a twelve block area in the community. An assistant fire chief and a police officer were among those killed. Forty-five buildings were involved in the ensuing conflagration.²⁴
- At Marshalls Creek, Pennsylvania in June 1964, six people were killed including three fire fighters who had responded to a reported truck fire. A truck driver hauling a trailer truck load of nitrocarbonitrate, dynamite, and blasting caps experienced two flat tires. He left the truck to seek assistance. During his

absence, the tires caught fire, exposing the trailer and its cargo. The explosion occurred after the arrival of the fire department. Fire fighters did not know that explosives were involved. The adequacy of placarding was an issue in this incident.²⁵

Fire Department Response

Before this incident occurred, the Kansas City Fire Department apparently had little or no information regarding the blasting activities at the construction site. For now it will suffice simply to recognize that neither the fire fighters in the fire stations nor the fire fighters in the dispatch center knew the quantity, type, or location of the explosives on the construction site.

While Pumper 41 was en route, the crew was advised of the possibility of explosives. However, the type of explosives and location was never stated. Once on the scene, Pumper 41 appears to have gained more information about the location of the explosives, possibly from the guards. This crew told the dispatch center that the explosives were supposed to be in this trailer that was burning on the hill, even though they were not provided with that information by the dispatcher.

Despite the discussion of explosives, Pumper 30 responded to the burning trailer and requested Pumper 41 to do the same, which it did. Since the officers and fire fighters who made the decision to attack the fire died in the explosion, no one will ever know what those fire fighters knew and why they operated as they did.

After the battalion chief had arrived on the scene and was able to size up the situation, he was preparing to remove all fire fighters to a safe distance, a common practice during hazardous materials incidents. Unfortunately, the explosion occurred before he could initiate the order. Once the explosion occurred, the battalion chief requested the assistance of the trained hazardous materials team from Kansas City, Kansas and eliminated further losses by keeping responding fire fighters at safe distances until additional information was available regarding the hazards.

Many questions about this incident remain unanswered. The questions address issues that fire fighters have to consider when responding to hazardous materials incidents.

- Why did both crews attempt to attack the fire in the trailers when there was no life hazard, when the fire was apparently more intense than a fire involving ordinary combustibles, and when there was mention of explosives in the area?
- Did the appearance of the trailers, i.e., standard over-the-road trailers without placards, special colors, or other visual cautions, decrease the potential hazard in the minds of the responding fire fighters?
- Did the fire fighters know about the two magazines and believe that the explosives were there and not in the trailers?
- Did the fire fighters realize that an explosive material can be the fuel for a fire and burn to detonation over time and did they know proper safe emergency procedures?

National Codes and Regulations

The intent of this section is to discuss current codes that regulate the manufacture, transportation, storage or use of explosives and the impact that these codes might have had on this incident. No attempt was made to provide a comparison of the conditions found at this incident with current Kansas City codes.

NFPA 495, Manufacture, Transportation, Storage, and Use of Explosive Materials, 1985, contains regulations for the storage of explosive materials. Section 2 of this code indicates that persons in possession of explosives must have either a license or permit under Title XI, 18 U.S.C. Chapter 40 or must obtain other proper permits. However, Section 6-4.6 requires that the local fire department be notified of the location of all magazines and be notified of all changes in location. NFPA 495 also requires that the property on which Type 2, 4, and 5 magazines are located be posted with signs reading "Explosives - Keep Off."

Explosives and blasting agents are covered by Article 77 of the 1988 Uniform Fire Code which is jointly sponsored by the International Conference of Building Officials (ICBO) and the Western Fire Chiefs Association. In addition, Sections 4.108 e.1 and 77.104 establish that a permit shall be obtained from the Bureau of Fire Prevention prior to engaging in activities involving the storage or use of explosives or blasting agents. Section 4.104 of the 1988 UFC also requires inspection of storage or

use areas. Section 77.304(a) requires blasting agents to be stored, handled, and used in the same manner as explosives.

Depending on the quantity of explosives, the UFC provides for the storage of explosives to be in one of two types of magazines, Class I or Class II. When the amount of explosives exceeds 100 pounds, only the Class I magazine is allowed to store more than one day's supply for use at the site of blasting operations [Section 77.201(j)]. A Class II magazine may be used for temporary storage of up to one day's supply of explosives at the site of blasting operations.

The 1988 UFC requires the Class II magazine to be of substantial construction, which may be accomplished by any of a number of alternatives [Section 77.204]. A trailer of the type previously described would not conform to either a Class I or Class II magazine.

Similar to NFPA 495, the UFC requires that the approaches to properties on which Class I magazines are located be provided with warning signs reading, "EXPLOSIVES - KEEP OFF" in red letters. The signs shall be within 100 feet of the magazine. The UFC also requires an additional warning sign on the door of the magazine reading, "EXPLOSIVES, DANGEROUS." Should a Class II magazine be used, the 1988 UFC requires the magazine to be painted red and to bear the letters reading, "EXPLOSIVES."

The NFPA and UFC requirements, if followed, might have affected the outcome of this incident because the fire department could have had increased knowledge about the hazards on the site before the incident.

Both the NFPA and UFC codes as well as ATF in Title XI, 18 U.S.C. Chapter 40, have adopted "The American Table of Distances for Storage of Explosives." This table establishes the minimum acceptable distances between explosive storage facilities and inhabited buildings, public highways, passenger railways, and other magazines in order to protect the public and property in the event of an explosion. For this incident, the two trailers are considered to be one storage facility and their contents are totaled together.²⁶ 87th Street and US 71, which were approximately 400 feet and 500 feet from the blast area, respectively, fall into the same category because both serve more than 3000 vehicles per day. Since no natural or manmade barricades were present between the trailers and 87th Street, the

table of distances requires a separation distance of 2000 feet for the quantities of explosives that were stored in the trailers.

The 3 X 4 foot piece of a pumper that landed on the south side of 87th Street was found approximately 500 feet away from the blast site; four people who were 340 feet away from the blast survived. Yet, the table of distances required a separation distance of 2000 feet. Thus, for this incident, the distance set by the table would have protected exposed people and buildings from flying debris.

Local Fire Codes

The blasting contractor applied for a blasting permit, which the city engineer's office issued. This office did not notify the fire department of the blasting permit on explosive materials stored and used at the site.

Following this incident, a review by local authorities of local and state laws indicated that the city may not have had any jurisdiction over the leased rock excavation site; yet, the city was still responsible for providing public fire protection for that area. Such potential conflicts between city, county, state and federal jurisdictions should be reviewed for code enforcement purposes and for communication between jurisdictions.

Post Incident Changes in Local Procedures and Policies

Following this incident, the Kansas City Fire Department examined current policies and procedures to identify methods to prevent this type of occurrence in their community. The fire department spent several weeks reviewing and evaluating most of the changes before they were enacted.

Almost immediately after the incident, the city fire marshal determined how many permits for blasting were active in Kansas City. He learned that the city engineer's office had records of 64 active permits, though the fire department was only aware of two blasting permits prior to their inquiry. This discovery has led to activities designed to improve communications between the city engineer's office and the fire department. The city now requires a blaster to get a permit from the fire department to store the explosives on the site before getting the permit from the city engineer's office to use explosives.

The fire department has also imposed the following requirements for storage of explosives within the city limits:

1. Before a permit will be issued, the applicant must submit a site plan of the proposed explosives storage area.
2. An 8-foot fence with barbed-wire must be constructed around the entire perimeter of the storage area.
3. All points of the fence must be at least 6-feet from the storage building or trailer, and the area within the fence must be clear of debris and other combustible materials.
4. The magazines within the storage area must be placarded with a sign meeting Department of Transportation requirements.

In addition to imposing these requirements, the fire department will periodically inspect all explosive storage facilities. Changes to the storage facility will require a resubmittal and reissuance of a storage permit.

V. CONCLUSIONS

This tragedy in Kansas City prompts a reexamination of lessons from past experience. It is clear that for decades the hazards of blasting agents in fires have been recognized by the fire service. Such recognition is reflected in identification systems and operating procedures. Today, there is an appropriate focus on training, planning, and emergency response procedures for a broad family of hazardous materials. Codes, standards, and procedures are available and need to be applied to avoid such tragic events in the future.

This incident involving the storage of blasting agents illustrates the potential hazard to fire fighters and others under certain fire exposure conditions. This incident also points to several key lessons for the fire service and those concerned with explosions, blasting agents, or other potentially hazardous materials.

1. Blasting agents such as ANFO can be extremely hazardous when exposed to fire and can detonate.
2. Prior to the alarm, the Kansas City Fire Department apparently did not have knowledge of specific details such as the type, quantities and location of the blasting agents. Permit systems for storage and use of explosives or blasting agents must include notification to the fire department.
3. It is normal practice to remove hazardous materials warning signs once an over-the-road trailer has reached its destination. Better marking of the areas of storage or the trailers might have saved lives in this case, given the lack of detailed prior knowledge about the location of the dangerous materials.
4. In addition to notification of fire departments about the location of explosives and blasting agents through a permit system, adequate pre-fire planning conducted by fire fighters can serve to locate hazardous materials throughout a department's jurisdiction. Such data gathering and inspections can find unexpected dangerous materials before an emergency occurs and thus save lives of fire fighters and civilians.

VI. END NOTES

1. Blasting Agent. Such materials or mixtures have been found to be so insensitive that there is little probability of accidental initiation of explosion or of transition from deflagration to detonation. The tests required by 49 CFR 173.114a include blasting cap sensitivity, differential thermal analysis, thermal stability, electrostatic sensitivity, impact sensitivity, and fire exposure. Code for the Manufacture, Transportation, Storage and Use of Explosive Materials, NFPA 495, 1985 ed., Quincy, MA.
2. Under normal blasting conditions, blasting agents require a large booster charge to detonate. The dynamite storage on the site was the material used as the booster and the blasting caps were used to detonate the dynamite.
3. Fertilizer Grade Ammonium Nitrate, Properties and Recommended Methods for Packaging, Handling, Transportation, Storage and Use, Fertilizer Institute, Washington, DC p. 3.
4. "The Texas City Disaster," The Quarterly, NFPA, July 1947, Vol. 41, No. 1, pp. 25 - 57.
5. Scott, G. S., and Grant, R. L., Ammonium Nitrate: Its Properties and Fire and Explosion Hazards, United States Department of the Interior, Bureau of Mines, I.C. 7463, June, 1948.
6. Greiner, M. L., "Ammonium Nitrate Hazards and Handling," Fertilizer Progress, January/February, 1983.
7. Blasters' Handbook, E. I. du Pont de Nemours & Company (Inc.), Wilmington, DE, 1977, p. 55.
8. Porter, S. J., Section 5, Chapter 7, Fire Protection Handbook, 16th ed., National Fire Protection Association, Quincy, MA., 1986, pp. 5 - 69.
9. Blasters' Handbook, E.I. du Pont de Nemours & Company (Inc.), Wilmington, DE, 1977, p. 55.
10. Porter, S. J., Section 5, Chapter 7, Fire Protection Handbook, 16th ed., National Fire Protection Association, Quincy, MA., 1986, pp. 5 - 69.

11. Blasters' Handbook, E. I. du Pont de Nemours & Company (Inc.), Wilmington, DE, 1977, p. 55.
12. Blasters' Handbook, E. I. du Pont de Nemours & Company (Inc.), Wilmington, DE, 1977, p. 54.
13. Blasters' Handbook, E. I. du Pont de Nemours & Company (Inc.), Wilmington, DE, 1977, Table 4.1 (p. 57) and Table 6.1 (p. 81).
14. Porter, S. J., Section 5, Chapter 7, Fire Protection Handbook, 16th ed., National Fire Protection Association, Quincy, MA, 1986, pp. 5 - 69.
15. Porter, S. J., Section 5, Chapter 7, Fire Protection Handbook, 16th ed., National Fire Protection Association, Quincy, MA, 1986, pp. 5 - 75.
16. Ibid.
17. Emergency Handling of Hazardous Materials in Surface Transportation, Bureau of Explosives, April 1981, p. 29.
18. Emergency Response Guidebook, 1987 ed., United States Department of Transportation, DOT P5800.4, Guide 43.
19. NFPA 1901, Standard on Automotive Fire Apparatus, 1985, defines a quintuple ladder truck as a ladder truck carrying the standard complement of ground ladders with the addition of a fire pump, water tank, hose body, and aerial ladder.
20. At the time that the Kansas City Fire Department dispatch center received the initial telephone call regarding this incident, the dispatchers at the center were handling a two-alarm fire. The first alarm was struck at 3:04 a.m. and the second alarm was struck at 3:33 a.m. During the course of the incident at the construction site, the dispatch center also handled several other fire and medical incidents.
21. Fire Protection Guide on Hazardous Materials, Ninth Edition, National Fire Protection Association, Quincy, MA 1986.
22. Information provided during the January 24, 1989 telephone conversation with R. W. Van Dolah, former employee of the U.S. Bureau of Mines and member of the NFPA Hazardous Chemicals Committee.

23. Porter, S. J., Section 5, Chapter 7, Fire Protection Handbook, 16th ed., National Fire Protection Association, Quincy, MA., 1986, pp. 5 - 70.
24. The Roseburg, Oregon, Fire, Explosion and Conflagration, August 7, 1959. National Board of Fire Underwriters, New York, NY.
25. "Explosives Truck Blast, Marshalls Creek, Pennsylvania," NFPA Quarterly, Vol. 58, No. 2, October 1964, pp. 172 - 177.
26. NFPA 495, Manufacture, Transportation, Storage, and Use of Explosive Materials, 1985 ed., Quincy, MA, Table 6-4b, Note 12.

VII. APPENDICES

TIME LINE^{1,2}

3:00 a.m.± Guards on construction site see prowler and join together in one vehicle.

Guards leave construction site and go to convenience store.

Motorist stops at convenience store and reports a vehicle fire at the construction site.

Guards return to construction site.

3:40:57 a.m.

Dispatcher: Fire Department.

Phone Call: Ah, yes I want to report a fire.

Dispatcher: Whereabouts?

Caller: It's on 71 Highway, in the southbound lane.

Dispatcher: OK, what's burning?

Caller: A truck.

Dispatcher: Big truck; small truck?

Caller: A small pickup truck.

1 This time line includes a transcript of the radio transmissions as recorded on the Kansas City Fire Department dispatch center tape. All radio transmissions related to this incident up to the first explosion have been included. After that, only a few selected transmissions have been included.

2 All radio transmissions associated with the two-alarm fire that was simultaneously in progress have been deleted.

Dispatcher: Pickup, OK. Whereabouts on 71?

Another voice, possibly female, in background: Oh, the explosives are on fire.

Dispatcher: Can you give me an intersection?

Caller: Yeah, there's a fire on both sides of the highway. It's at 87th Street.

Dispatcher: 87th and 71 Highway? What's burning?

Caller: Ah, there may be some... ah, there's some explosives up on a hill that I also see now is burning.

Dispatcher: OK, we'll have units there. Thank you.

Caller: Uh-huh.

3:42:19 a.m. Still Alarm³

Dispatcher: Pumper 41. This is a pickup truck at... south of Blue River and 71 Highway on the west side. Pumper 41, reported to be a pickup truck on Blue... just south of Blue River and 71 Highway on the west side.

3:42:50 a.m.

Dispatcher: Pumper 41, use caution on your call. There's information there may be explosives. It's in or at a construction area. The pickup truck may be in that area.

3:43:56 a.m.

Pumper 41: 41 clear.⁴

Dispatcher: 41 clear.

3 A "Still Alarm" is initiated in the Kansas City Fire Department when fire apparatus are dispatched but a full assignment is not required.

4 "Clear" indicates that the responding apparatus is clear of the fire station.

3:46:38 a.m.

Pumper 41: 41's is 97.

Dispatcher: 41 on the scene.

3:47:26 a.m.

Pumper 41: 41 to dispatcher.

Dispatcher: 41.

Pumper 41: We have two fires down here. One west of Blue River and one east of Blue River. You better get another pumper company down here.

Dispatcher: Message received.

3:47:43 a.m. Still Alarm

3:47:45 a.m.

Dispatcher: Pumper 30 went on to call Pumper 41 in the vicinity of Blue River and 71 Highway. Pumper 30 with Pumper 41 make the call in the vicinity of Blue River and 71 Highway. Check with Pumper 41 when you get in the area.

3:50:17 a.m.

Pumper 30: 30 Pumper's clear.

Dispatcher: 30 clear.

3:52:57 a.m.

Pumper 30: 30 Pumper 10-97.

Dispatcher: 30 on the scene.

3:57:20 a.m.

Pumper 41: 41 to dispatcher.

Dispatcher: 41.

Pumper 41: It appears to be two arson fires out here. Send the police.

Dispatcher: 10-4. Is that on vehicles?

Pumper 41: 10-4. Ah, 41. 31...41 to 30's Pumper... 41 to 30's Pumper.

3:58:01 a.m.

Pumper 41: 41 to dispatcher.

Dispatcher: 41.

Pumper 41: If you can get 30, tell them that there's a trailer on fire up there, stay away from it, and we better have 107 out here. There's supposed to be explosives involved in this.

Dispatcher: Pumper 30.

Pumper 30: Pumper 30, 10-4.

Dispatcher: Do you want 107 emergency?

Pumper 41: Yeah, you can send him emergency.

3:58:24 a.m. Still Alarm

Dispatcher: Car 107 make the alarm. The companies are just...um...south of Blue River and 71 Highway. Pumper 41's on the west side. 107 make the alarm. It's just south of Blue River and 71 Highway on the west side.

3:59:29 a.m.

Pumper 30: Pumper 30 to dispatcher.

Dispatcher: 30.

Pumper 30: Can you confirm that there is explosives in this trailer or not?

3:59:38 a.m.

Dispatcher: Pumper 41 advised that, and we had additional information on the original call there were explosives in that area to use caution.

Pumper 30: Pumper 30, 10-4. Send 41's up here when they're through.

Dispatcher: 41, did you copy 30's message?

3:59:58 a.m.

Pumper 41: 41, 10-4; we're en route now.

Dispatcher: 10-4.

4:02:07 a.m.

Pumper 41: 41 to dispatcher. 41 to 107.

4:02:12 a.m.

Car 107: 107.

Pumper 41: The way it looks right now we're going to have to haul some water up in here with a squad or something. We've got a trailer and one of the compressors going up here.

Car 107: You need a four-wheel drive back in there?

Pumper 41: Yeah, you can get a four-wheel drive back in here.

Car 107: 107 to dispatcher.

Dispatcher: 107.

Car 107: Did you read 41's needing a four-wheel drive squad in there?

Dispatcher: Message received.

4:04:18 a.m.

Car 107: 107 to Pumper 41.

4:04:24 a.m. Still Alarm

Dispatcher: Squad 42 with the four-wheel drive responding to just south of Blue River and 71 Highway meet the companies.

Pumper 41: 41 to 107.

Car 107: Yeah, are you on the east side or the west side, Jim?

Pumper 41: East side.

Car 107: 10-4.

Pumper 41: 41 to 107.

Car 107: 107.

4:04:49 a.m.

Pumper 41: Apparently this thing's already blown up, Chief. He's got magnesium or something burning up here.

Car 107: 10-4. Are you back up in there now or where are you at?

Pumper 41: 10-4. Both companies are back up in here.

Car 107: Can you get in off 71?

Pumper 41: Right. It's ah... it's a road they're using for construction here.

4:05:12 a.m.

Car 107: 10-4.

4:06:21 a.m.

Car 107: 107 on the scene.

Dispatcher: 107, 10-4.

4:08:15 a.m.

Car 107: 107 to dispatcher.

Dispatcher: 107.

Car 107: ... explosion just as we pulled up in here. Get us all kinds of ambulances in here. Get us ambulances and at least a couple of, three more companies.

Dispatcher: 107, you're reporting an explosion? You need extra companies?

Car 107: 10-4. We're going to need ambulances.

Dispatcher: 10-4. Is that for fire fighters?

Car 107: 10-4. We blew the windshield clear out of our car and we're a quarter of a mile away.

Dispatcher: 10-4, chief... Pumper 36, Pumper 37, Quint 42, Quint 28 and Squad 28, make the alarm. That be for Pumper 36, Pumper 37, Quint 42, Quint 8, make the alarm, Quint 8 and Squad 28. A major explosion, fire fighters are involved, fire equipment, it'll be, uh, just north of Blue River or, correction, just south of Blue River and 71 Highway.

Pumper 36: Number 36 clear.

Dispatcher: 10-4. 101, did you receive? 101? 107 reports a major explosion. We heard it here. Fire fighters are involved out at that 71 Highway and 87th. Apparently a large explosion.

101: 10-4. Any injuries?

Dispatcher: The order said send a bunch of ambulances. We're probably going to have fire fighters involved, from what he said.

101: 10-4. (Assorted chatter takes place.)

Dispatcher: All companies responding to 87th and 71, use caution goin' in, apparently there are explosives in the area.

Car 107: 107 to dispatcher.

Dispatcher: 107.

Car 107: Who all was at the scene of this alarm besides 107 when we had the explosion?

Dispatcher: Initially, you had 41's and 30 pumpers. Squad 42 was comin' in, and yourself, and we have sent additional companies.

Car 107: OK, but we had 30's and 41's at the scene fightin' the fire? (Germann's voice cracks.)

Dispatcher: 30's was, as far as we know, they were near the trailer. 41's was coming up to 'em.

Car 107: 107 to Pumper 41. (18 second pause) 107 to dispatcher.

Dispatcher: 107.

Car 107: Give us what hazmat expertise you have out here. Notify everyone that we want to keep everyone back away from the area until we know more about it. And see if you can find someone from the, ah people who are workin' here to see if we can find more about the area.

Dispatcher: 10-4, 107, we'll do the best as we can. Uh, you are requesting hazmat? 107?

Car 107: 10-4.

Dispatcher: Chief, I'll see if we can get you one out of Kansas City, Kansas.

Unidentified voice: Chief, it looks like we have fires along 87th Street quite a ways from the explosion; it's evidently throwed the fire up on top of the hill, and by that vacant house.

Car 107: 10-4, use caution, we may still have more explosions going up there. We've had a terrible explosion.

4:19 a.m. 107: 107 to dispatcher.

Dispatcher: 107.

Car 107: Can you do any toning to try to raise any information?

Dispatcher: I'll do my best, chief. (sends tones on radio)... Pumper 41 or Pumper 30, answer. Pumper 41 or Pumper 30.

4:20 a.m.

Car 107: We need, we need to know for sure from someone in the area who is in control of the situation, as far as the, ah, equipment, and such as that, what we still got up there. We've had a tremendous explosion, we've got what appears to be some parked... hold everybody in their position.

Dispatcher: Attention all companies on mutual aid. We've had a major explosion in the area of 87th and 71 Highway. 87th and 71 Highway. It's in Kansas City, Missouri. It involves chemicals. We don't much further than that at this time. We may be requesting mutual aid in our city.

4:22 a.m.

Car 107: 107, have you ever been able to tone to see if you can raise anyone? Either 41's or 30's?

Dispatcher: I tried, chief. I'll try again. (Tones radio) Pumper 30, Pumper 41, answer. Pumper three-zero. Pumper four-one, please answer.

Dispatcher: 107.

Car 107: 107.

Dispatcher: We have information there may be uh, three more depots of explosives in that area that haven't blown are just as equivalent, uh, be advised of that.

Car 107: 10-4.

101: 101 to 107.

Car 107: 107.

101: Now, we're coming in here from, uh, 87th Street, from the east, uh, where are you now?

Car 107: We're just gettin' ready to back clear off of this hill. We've been notified we've got two or three times that much more ready to, that may explode, we don't know. Uh, chief, we were half, a quarter mile away and it blew the front end out of our buggy and blew the car backwards about 50 feet.

4:48 a.m.

101: 101 to dispatcher.

Dispatcher: 101.

101: We've just had a secondary explosion in the area.

Dispatcher: That's received. 101 reporting a secondary explosion in the area. Attention all mutual aid stations, we've had a secondary explosion at 87th and 71.

5:00 a.m.± Hazardous materials officer attempts to observe the fire scene from a helicopter. Can see very little.

5:20 a.m.±

Two fire fighters enter area and locate five of the six fire fighters that had been killed.

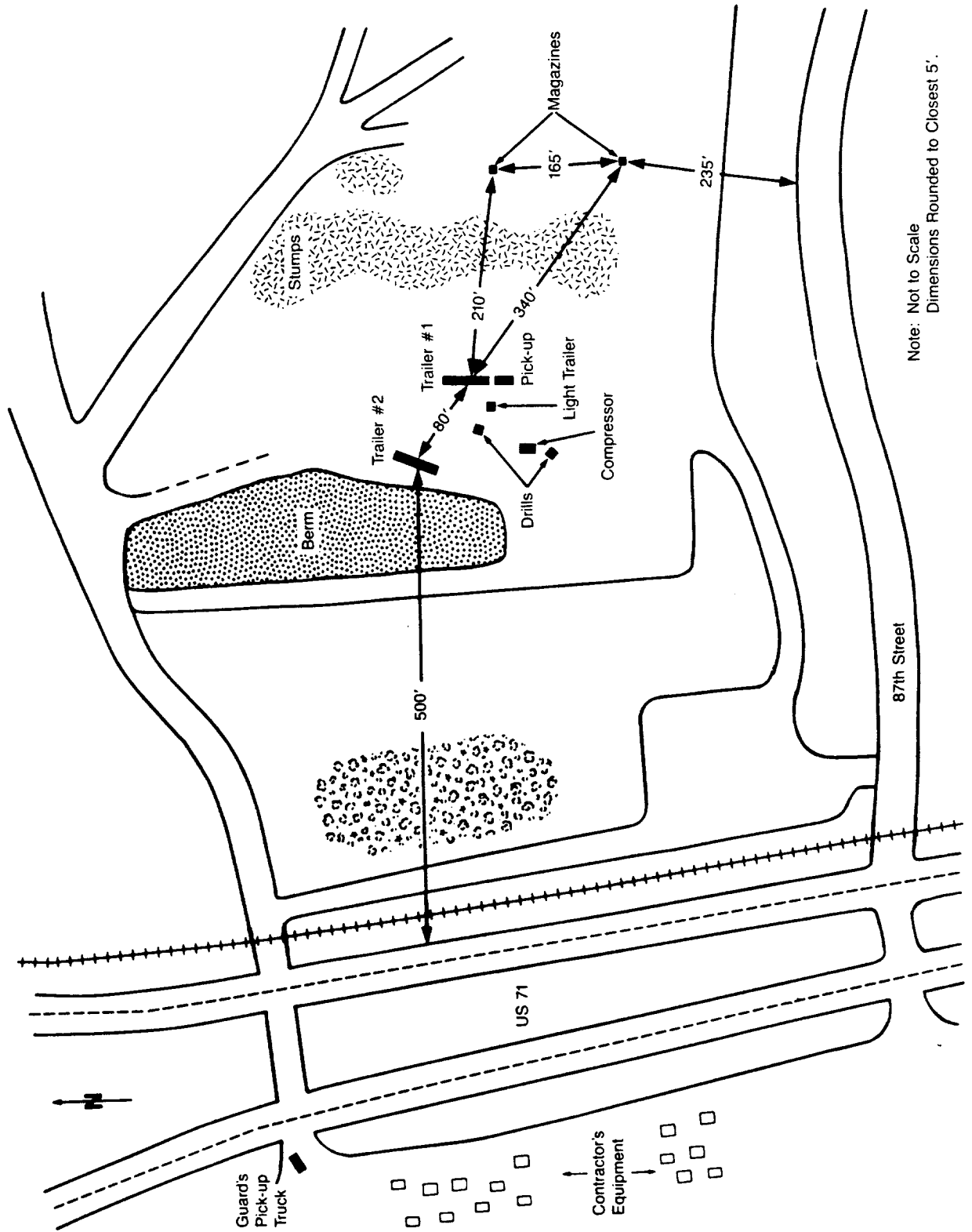
**6:00 -
6:30 a.m.**

The rising sun provides sufficient light for police and fire personnel to enter the fire scene. Police personnel enter fire scene and declare area a crime scene.

Fire department chief officers enter the area, but are requested by police to limit their movement to prevent evidence from being damaged.

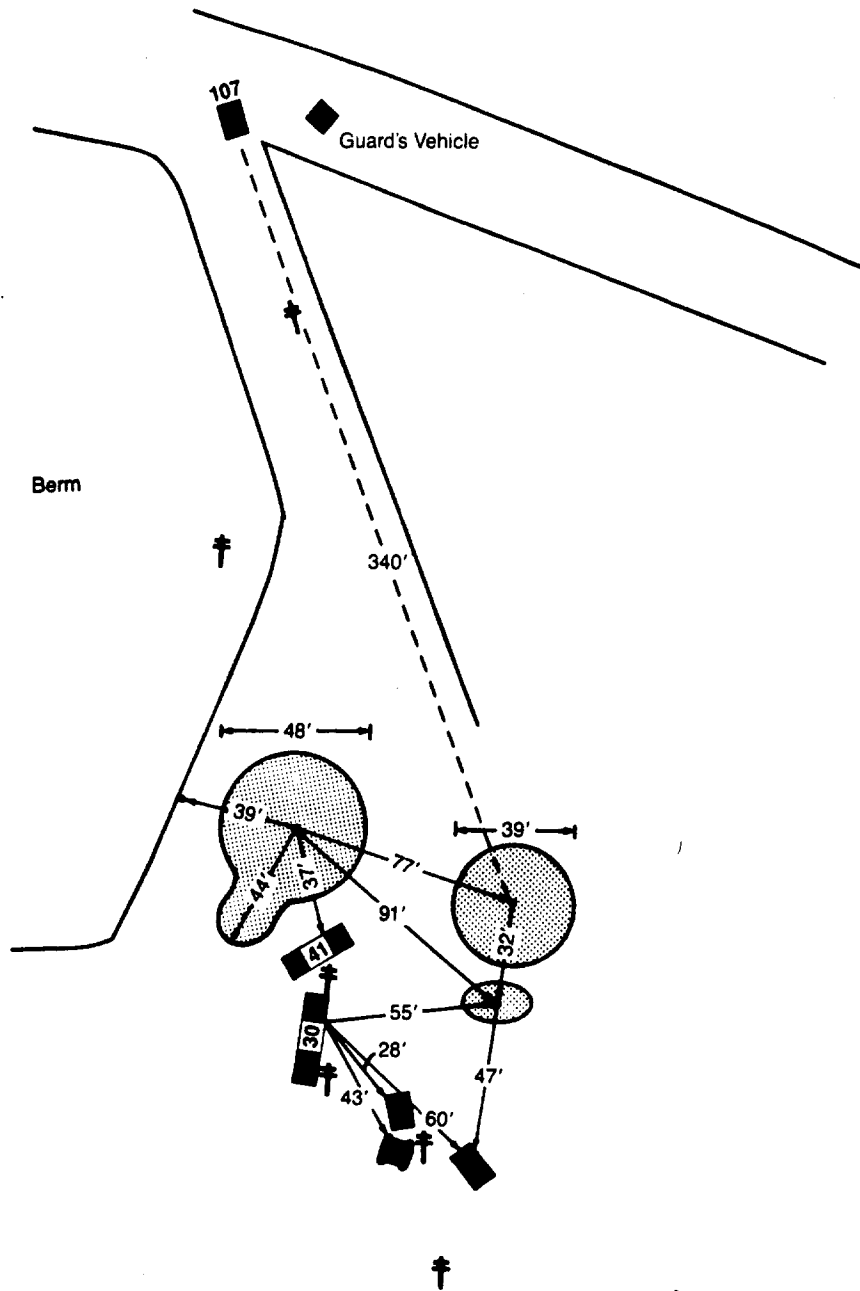
Construction Site and Surrounding Area

Figure 1



Note: Not to Scale
Dimensions Rounded to Closest 5'.

Blast Site Figure 2



Note: † = Location of Fatality.
Measurements were taken by NFPA ICBO.